LOW PROFILE ROLLER SKATE

Background

Cross Reference to Related Applications

[0001] This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/451,321, filed on February 28, 2003 and U.S. Provisional Patent Application Serial No. 60/518,576, filed on November 7, 2003, the entire contents of which are incorporated herein by reference.

Field of the Invention

[0002] The invention relates in general to the field of roller skates, and specifically to a skate configured to be worn over a street shoe.

Description of the Related Art

[0003] Roller skates have been used by many people for many years for recreation, entertainment, sports and transportation. There have been innumerable variations to the basic roller skate, such as inline skates, skates integral with tennis shoes, etc. There have also been a number of designs of skates configured to be strapped to and worn over street shoes. For example, many people remember the classic steel skates with leather straps and "skate keys" for adjustment of the skates. This basic concept has also been modified and improved upon, for example U.S. Patent No. 4,334,690 to Klamer et al. teaches a strap-on skate adapted to assist people in learning to skate, and U.S. Patent No. 4,072,317 teaches an inline strap-on skate.

[0004] Notwithstanding the particular advantages of each of the above-mentioned designs, there remains room for improvement to many of the classic roller skate designs including that of a strap-on roller skate to be worn over a street shoe.

Summary

[0005] One embodiment of a low profile roller skate has a chassis to which a wearer's shoe or foot can be securely fastened. Front and rear axles extend from angled slots in either side of the chassis, and are biased toward a horizontal, straight-ahead position. A wearer can steer the skate by leaning in the direction of a desired turn, thus causing the axles to move along the slots and pivot in a direction which causes the wheels to turn in the desired

direction. The wheels can be biased toward a straight-ahead position by resilient torque blocks sandwiched between top and bottom chassis halves. The skate can further be provided with toe and heel brakes, removable grind pads, over-molded wheels, and quick-release straps.

[0006] According to one embodiment, a roller skate is provided which comprises a bifurcated chassis with first and second chassis halves, said first chassis half having an upper surface adapted to support a wearer's foot. A pair of foot-retaining wings is mounted on either side of the chassis, and front and rear axles are mounted between the first and second chassis halves and configured to support wheels.

[0007] According to another embodiment, a roller skate comprises a skate body having a top surface, a bottom surface, a front surface, a rear surface and a pair of side surfaces. A front axle extends through the side surfaces at a front portion of the skate body, and a rear axle extends through the side surfaces at a rear portion of the skate body. The front and rear axles are positioned between the top and bottom surfaces of the skate body, and a plurality of wheels are rotatably mounted to the axles. The skate of this embodiment is configured to turn in a desired direction as a wearer leans in that direction.

[0008] Another embodiment of a roller skate comprises a skate chassis having an upper surface, a lower surface, and a pair of side surfaces and an axle extending through an angled slot in one of the side surface of the chassis. The slot has a first end, a second end, and a center. A pair of wheels is mounted to opposite ends of the axle, and a biasing element is provided to bias the axle toward the center of the slot. The biasing element can comprise a block of resilient material surrounding a portion of the axle.

[0009] Still another embodiment of a roller skate comprises a platform adapted to support a street shoe, and a plurality of wheels straddling the platform. The tops of the wheels extend above said platform, and retaining elements are provided to secure a street shoe on the platform. According to this embodiment, at least a portion of the street shoe is located between the wheels.

[0010] Yet another embodiment provides a roller skate wheel comprising a wheel hub with a bearing hole, a hub ring and a capture ring. The wheel hub comprises an annular space between the capture ring and the hub ring that is configured to receive a tire. A tire made of a thermoplastic material is molded over the hub ring and the capture ring such that

the thermoplastic material extends into the annular space between the hub ring and the capture ring.

[0011] Another embodiment provides a method of making a skate wheel comprising: injection molding a urethane material over a hub to form a wheel.

[0012] All of these embodiments are intended to be within the scope of the present invention herein disclosed. These and other embodiments of the present invention will become readily apparent to those skilled in the art from the following detailed description of the preferred embodiments having reference to the attached figures, the invention not being limited to any particular preferred embodiment(s) disclosed.

Brief Description of Drawings

[0013] Having thus summarized the general nature of the invention, certain preferred embodiments and modifications thereof will become apparent to those skilled in the art from the detailed description herein having reference to the figures that follow, of which:

[0014] FIG. 1. is a top, right, rear perspective view of a roller skate having desired features and advantages.

[0015] FIG. 2. is a top, left, rear perspective view of the roller skate of FIG. 1.

[0016] FIG. 3. is a bottom, right perspective view of a top half of a bifurcated skate chassis.

[0017] FIG. 4. is a top, right perspective view of a bottom half of a bifurcated skate chassis.

[0018] FIG. 5. is a bottom plan view of the skate of FIG. 1.

[0019] FIG. 5b is a bottom plan view of an alternative embodiment of the skate of FIG. 1.

[0020] FIG. 6. is a front elevation view of the skate of FIG. 1.

[0021] FIG. 7. is a rear elevation view of the skate of FIG. 1.

[0022] FIG. 8. is a left side elevation view of the skate of FIG. 1.

[0023] FIG. 9. is a right side elevation view of the skate of FIG. 1.

[0024] FIG. 10. is a bottom, left perspective view of the skate of FIG. 1.

[0025] FIG. 11. is top plan view of the skate of FIG. 1.

[0026] FIG. 12. is a side sectional view taken through line 12-12 of FIG. 11.

[0027] FIG. 13. is a side sectional view taken through line 13-13 of FIG. 11.

[0028] FIG. 14. is a side sectional view taken through line 14-14 of FIG.11.

[0029] FIG. 15. is an exploded view of a low profile skate having desired features and advantages.

[0030] FIG. 16a is an exploded view of one embodiment of a torque block, shock pad and axle assembly of the skate of FIG. 15.

[0031] FIG. 16b is an exploded view of an alternative embodiment of a torque block, shock pad and axle assembly of the skate of FIG. 15.

[0032] FIG. 17 is an exploded view of an axle and wheel assembly in accordance with an embodiment of the invention.

[0033] FIG. 18 is a front perspective view of one embodiment of an over-molded wheel for use with the skate.

[0034] FIG. 19 is a rear perspective view of one embodiment of an over-molded wheel for use with the skate.

[0035] FIG. 20 is a front side elevation view of the wheel of Figure 18.

[0036] FIG. 21 is a cross-sectional view of the wheel of FIG. 20 taken through line 21-21.

[0037] FIG. 22 is a cross-sectional view of the wheel of FIG. 21, taken through line 22-22.

[0038] FIG. 23 is a perspective view of a tire portion of one embodiment of a molded wheel.

[0039] FIG. 24 is a rear perspective view of a hub portion of a molded wheel.

[0040] FIG. 25 is a front perspective view of the hub portion of FIG. 24.

Detailed Description of the Preferred Embodiments

[0041] Although many of the following embodiments are described in terms of a removable over-shoe roller skate, it will be clear to those skilled in the art that many of the advantages of the skate shown and described herein can also be achieved by a skate with a shoe or boot integrally or permanently mounted to the skate body for retaining the skate on a wearer's foot. As will also be clear to the skilled artisan in view of the present disclosure, no single feature or element is considered to be essential to the practice of the invention. Many of the features described below can be made or used individually or in various additional combinations beyond those described without deviating from the invention.

[0042] With reference to the attached Figures, a roller skate 10 adapted to be worn over a normal street shoe and providing improved stability and performance will be described. The term street shoe, as used herein, carries its ordinary meaning, and refers generally to any shoe which would normally be worn by a person walking down the street. The term is intended to include tennis shoes, hiking boots, dress shoes, etc. The skate 10 is generally characterized by a relatively low center of gravity resulting, at least in part, from the unique axle configuration. The skate 10 generally comprises a chassis or body 12 having a top platform 14 for supporting a user's foot, and front and rear axles 16a and 16b extending from the sides of the body 12 to support wheels 18. The skate is also generally provided with a shoe-receiving portion comprising "wings" 20 for surrounding and securing a shoe to the platform 14 of the skate body 12. Brake pads 22(b & a) and grinding pads 24 can also be affixed to the underside of the body 12 as will be further described below.

[0043] With reference to Figures 1 and 8, the skate chassis 12 includes a toe portion 26 surrounding and extending forward from the front axle 16a, an arch portion 28 extending between the front 16a and rear 16b axles, and a heel portion 30 surrounding and extending rearward from the rear axle 16b. The skate 10 can advantageously be sized such that a ball of a user's foot is substantially above the front axle 16a, and a heel of a user's foot is substantially above the rear axle 16b. The toe portion 26 of the skate body 12 can have an upward curve (seen best in Figures 8 and 9) in order to provide clearance for the toe brake 22a and to provide an ergonomic fit which allows a user to more easily push off the ground with the toe of the skate as well as to slow down by dragging the toe brake, and to stand on the toe in a stopped position. The length of the toe portion 26 which extends forward of the front axle 16a can be varied according to a number of factors including a shoe size which a particular skate is designed to fit.

[0044] With reference now to Figure 5, the skate chassis can generally have a length dimension 102 of between about 7" and about 16" depending on the desired shoe size to be matched. Similarly, the skate 10 can have a front width dimension 104 of between about 3.5" and about 7", and a rear width dimension 105 of between about 3" and about 6". The skate chassis 12 can be made to be substantially symmetrical across the longitudinal axis of the skate as shown. This provides the unique advantage of allowing either one of a pair of skates to be worn on either a wearer's left or right foot.

[0045] The size of the skate chassis 12 can be varied to fit a range of shoe sizes. The various sizes can be achieved by proportionally scaling all the dimensions of the skate, or by varying select dimensions while holding other dimensions constant. For example, the skate can be made larger or smaller by changing only a length dimension 108 between the front and rear axles 16a and 16b, or by changing a length dimension 110 between the front axle 16a and front tip of the skate, or by changing a length dimension 112 between the rear axle and the rear of the skate. Thus, in some embodiments, a toe-to-front-axle dimension can be between about 2" and about 5", and a heel-to-rear-axle dimension can be between about 1.5" and about 4". Similarly, an axle-to-axle dimension can be between about 3.5" and about 9".

[0046] The chassis 12 will typically be sized such that the wearer's foot will be supported as close to the ground as possible. The front axle 16a can be between about 1/4" and about 1 ¼" below the top of the platform 14, often between about 3/8" and about 7/8" and in one particular embodiment, the front axle 16a is about ½" below the platform 14. As illustrated in Figure 12, the rear axle 16b is further below the platform than the front axle 16a, this provides a slightly forward-leaning stance to a wearer, thereby creating a more stable riding position. Thus, the rear axle 16b can be between about 1/4" and about 1 ¼" below the top of the platform 14, often between about 3/8" and about 7/8", and in one particular embodiment, the rear axle 16b is about 5/8" below the platform 14. The distance between the axles 16a and 16b and the chassis bottom surface is preferably sufficient to allow the bottom surface of the skate 10 (and any grind pads 24 attached thereto) to clear the ground when the skate is leaned to one side during a turn as will be further described below. Thus, the distance between the axles 16a and 16b and the bottom surface of the skate 10 can be between about 1/4" and about 3/4", often between about 1/4" and about ½", and in one particular embodiment, the axles are about 3/8" above the bottom surface of the skate.

[0047] With reference again to Figures 8 and 9, the heel portion 30 of the skate may comprise a raised flange 32 against which a heal of a wearer's shoe abuts. The heel flange 32 can have a height of between about ¾" and about 2", often the height is between about ¾" and about 1 ¼", and in one embodiment the heel flange 32 is about 2" tall. Alternatively, the heel flange 32 can be any appropriate height such that a wearer's foot is tightly, but comfortably held by the skate 10. The platform 14 at the heel portion 30 can be

slightly raised relative to the platform 14 underlying a ball of a wearer's foot. By providing a raised heel, a wearers foot is placed in a balanced, forward-leaning position while the skate is worn, this allows for added comfort and performance.

[0048] As shown in Figures 3 and 4, the body 12 can be formed of a pair of mating halves 34 and 36. The illustrated halves 34 and 36 can be injection molded from a suitable thermoplastic material such as a glass-fill nylon, in one embodiment a 20% glass fill nylon. The chassis halves 34 and 36 can be molded to have any suitable wall thickness. For example, the halves 34 and 36 can be molded to have a wall thickness from about 0.050" to about 0.090", and in one embodiment the halves are molded with a 0.060" wall thickness.

[0049] The halves 34 and 36 can generally include features allowing the top 34 and bottom 36 halves to be joined to one another to form the skate chassis 12. A number of suitable structures exist for attaching the top 34 and bottom 36 chassis halves to one another, for example, the halves can be joined using any separable or integrally-formed fastener, adhesives, welds etc. In the illustrated embodiment, the halves 34 and 36 are adapted to be attached to one another using a plurality of screws or other similar fasteners. Thus, the top half 34 can have a plurality of posts 38 configured to receive a plurality of screws for securing the bottom half 36 and any other components to the top half 34. As shown, the posts 38 can comprise a plurality of radially-extending ribs 50 in order to provide lateral support for the posts 38. In alternative embodiments, the body 12 could be formed of a single unitary piece of material into which the components could be inserted. Alternatively still, the chassis 12 could comprise three or more sections while still retaining aspects of the present invention.

[0050] As can also be seen in Figures 3 and 4, the top 34 and bottom 36 halves can be provided with extensive ribs 50 in order to enhance the strength characteristics of the skate chassis 12 while minimizing the weight of the skate. By providing a ribbing network such as that shown for example, the skate chassis 12 can be made from a lightweight plastic and still maintain sufficient strength and rigidity to withstand the loads incurred by the skate during use. In alternative embodiments, the skate chassis 12 can be made from other materials and/or in other shapes such that the desired strength is achieved.

[0051] In one embodiment, such as is visible in Figure 12, the ribs 50 of the top 34 and bottom 36 halves may include interlocking sections 52 which will engage one another

as the top and bottom halves 34 and 36 are assembled, thereby preventing the top 34 and/or bottom 36 halves from undesirably flexing or shifting relative to one another. As will be clear to the skilled artisan, any number of other rib or web arrangements can be used to provide sufficient rigidity, and/or to retain the top and bottom halves in a substantially fixed relationship to one another.

[0052] The chassis halves 34 and 36 can also be configured to receive and retain various other components of the skate which will be described in further detail below. For example, the top 34 and bottom 36 chassis halves can include hollow boxes 86 for receiving structures for supporting and biasing the axles 16. The boxes 86 typically include slots 87 adapted to allow for a pivoting motion of the axles 16 as the skate turns. Additionally, the top and bottom halves can include holes or recesses for receiving brake pads 22, grind pads 24, and attachment tabs 46 of the wings 20.

[0053] The skate 10 can be provided with a plurality of straps and/or side sections for securing the skate 10 to a wearer's shoe. In the illustrated embodiments, the skate 10 includes side sections 20, otherwise referred to herein as wings 20, which are generally adapted to support each side of a wearer's shoe. A plurality of straps 40 can span between the wings 20 for tightly securing the skate 10 to a shoe. In the illustrated embodiment, the skate includes a front 40a strap and a center 40b strap both adapted to overlie a front section of a wearer's shoe, and a rear 40c strap configured to surround a rear portion of a wearer's ankle. The wings 20 can be made of a substantially flexible material such as ethylene vinyl acetate (EVA), such that they may be substantially collapsed and folded inward when the skate is not in use. Alternatively, the wings 20 may be made of a somewhat more rigid material, such as a polyvinyl chloride (PVC) or other vinyl material. The particular design of the wings 20 and the location of the point of attachment of the front 40a and rear 40c straps to the wings 20 provide guard portions 42 which can prevent a wearer's shoe from contacting the wheels 18.

[0054] The straps 40 can include any type of strap or buckle found to be suitable. For example, the straps could include leather straps with metallic buckles, or more preferably, the straps 40 include plastic ratcheting straps with quick-release buckles 44. Many suitable quick-release buckle/strap combinations are known to those skilled in the art, many of which are commonly used in board sports (such as snowboarding, skiing, etc).

[0055] As shown in Figure 15, the wings 20 may comprise tabs 46 which may extend between the top and bottom halves 34 and 36 such that the tabs 46 are sandwiched therebetween and thus secure the wings 20 to the skate. As can be seen in Figure 3, the upper half of a bifurcated skate chassis 12 can include cutouts 48 through which the wing attachment tabs 46 may extend. The tabs 46 are can be configured to surround the protruding posts 38. The posts 38 can be provided with a shoulder 120 such that the tabs 46 will be compressed between the shoulder 120 and the bottom chassis half 36 when the skate is assembled. In alternative embodiments, the wings 20 can be integrally formed with either the top or bottom half 34 or 36, or the wings 20 may be attached to the skate 10 by adhesives or other appropriate methods.

[0056] The skate 10 can be provided with front and/or rear brake pads 22 as desired in order to provide a replaceable pad which can be used to stop or slow forward and/or rearward motion of a wearer. The brake pads 22 typically include counter-bored holes for receiving fasteners for securing the brake pads to the skate chassis 12. The brake pads are generally made from a plastic material which will provide the desired degree of friction when dragged on the ground. For example, the brake pads 22 can be molded or cast from an elastomer, a thermoplastic elastomer, or other plastic or rubber material. In some embodiments, as shown in Figure 5b, the brakes 22a and 22b can be over-sized relative to the skate chassis 12 such that the brake pads 22a and 22b extend beyond the skate chassis 12, thereby allowing the brake pads to function as "bumpers" as well as braking elements.

[0057] As shown, the front and rear brakes 22a and 22b can each be configured to be attached to the skate chassis 12 by a single screw 54a and 54b each to allow for easy replacement of the brake. The screw 54 is received in a post or column boss 39 supported by a plurality of radially-extending ribs 51. According to one embodiment, the screws 54 and corresponding columns 38 are sized such that each screw will "bottom out" in its corresponding hole. Sizing the screws such that they will abut the bottom of the hole, will substantially limit the loosening of the screw due to vibrations experienced by the skate during normal use. Alternatively, the columns 38 may include threaded metallic inserts or T-nuts mounted therein to substantially reduce the possibility of the threads being stripped. The brake pads 22 can include recesses 23 (See Fig. 15) adapted to receive one or more of the ribs 51 surrounding a cruciform column 39 to which the brake pads can be attached. The

loosening of the brake pads 22 can be further controlled by providing an opening 56 in the bottom half 36 of the chassis 12 through which at least a portion of the brake pads 22a and 22b can extend (see Figure 4).

[0058] Some professional users often ride skates on "half pipes" or other man made structures to perform tricks. Many of the tricks performed on such structures involve sliding or "grinding" the bottom of the skate along various rails or edges. Thus, it can be desirable to include wear pads or grinding pads 24 along a bottom surface of the skate 10. Figure 5 illustrates one embodiment in which a single grinding pad 24 extends across substantially the entire bottom surface of the skate chassis 12 between the front and rear brakes 22a and 22b. In alternative embodiments, grinding pads 24 can be provided in multiple replaceable pieces as desired.

[0059] With reference to Figures 6-9, the grind pads 24 are typically configured to include concave recesses 58 along both the longitudinal and transverse axes. This allows a user to grind along a rail with the longitudinal axis of the skate 10 oriented parallel to the rail as well as with the longitudinal axis of the skate oriented perpendicular to the rail. The longitudinal concave portions 58 generally extend vertically below the front 22a and rear 22b brake pads such that the grind pad 24 will contact the rail or grinding surface without wearing down the brake. Alternatively, grind pads 24 can be configured to include a concave recess in only a single direction, or a grind pad may have a substantially flat bottom surface. In some embodiments it may be desirable to provide features such as protrusions or ridges on the bottom surface of the grind pad 24 to allow the grind pad to capture a rail or other grinding surface in order to prevent the skate from undesirably sliding in a direction normal to a grinding direction.

[0060] Grinding pads 24 can be made from any appropriate material such that they are substantially wear resistant, and have a relatively low coefficient of friction. For example, the wear pads 24 may be molded from an acetal copolymer or other substantially wear-resistant plastic. If desired, a plastic used for the grind pads can be enhanced by adding a fluoroadditive filler material. Appropriate additives, known by the trademark ZONYL are made by DUPONT as part of the family of products under the trademark TEFLON. Alternatively the grind pads 24 could be made from a metal by machining, casting, or any

other appropriate method. Such a metal could also be coated with a TEFLON or other friction-reducing product if so desired.

[0061] As shown in Figure 5, the bottom chassis half 36 can include a recess 60 configured to receive a grind pad 24. A lip surrounding the grind pad recess 60 provides support against lateral movement of the grind pad 24, and reduces the possibility of loosening of the fasteners holding the grind pad 24 to the skate chassis 12. The grind pad 24 can be attached to the skate chassis 12 by any appropriate fastener desired. The grind pad 24 typically includes a plurality of holes 64 for receiving a fastener to secure the grind pad 24 to the skate chassis. As can be seen in Figure 10, the fastener holes 64 are typically counter-bored to a sufficient depth to prevent the heads of the fasteners from being ground down during use.

[0062] In the embodiment shown in Figure 12, the grind pad 24 is configured to be attached to the skate chassis 12 by the same screws which attach the top 34 and bottom 36 chassis halves to one another. In this arrangement, a plurality of screws 55 extend through the grind pad 24 through the bottom chassis half 36 and engage posts 38 formed in the top chassis half 34. This provides for simple assembly of the entire skate using a relatively small number of fasteners. In alternative embodiments, more fasteners, and/or fasteners of varying types can also be used to attach a grind pad 24 to a skate 10. For example, a plurality of longer screws could be used to attach the top and bottom chassis portions 34 and 36 to one another, and a plurality of shorter screws could be used to attach the grind pad 24 to the chassis 12. Alternatively, the grind pad 24 could include integral structures allowing the grind pad 24 to be "snapped" onto a bottom surface of the skate 10. Once the grind pad 24 has been worn down to such a degree that a user desires to replace it, the screws 55 can be easily removed, and the pad 24 can be easily replaced.

[0063] With reference now to Figure 13, steering of the skate (e.g. rotation of the skate about the yaw axis) is accomplished by causing the axles 16a and 16b to pivot about an axle pivot axis in response to a wearer pivoting the skate 10 about the roll axis (while the skate is in contact with a solid surface), and ultimately causing the skate 10 to pivot about the yaw axis. In order to accomplish this, the chassis includes angled slots 66 through which the axles 16 extend. The slots 66 are generally adapted to provide steering control of the skate 10 as the wearer leans to one side or the other. The front axle 16a extends from a slot 66a

which angles upward from front to rear, and the rear axle 16b extends from a slot 66b which angles downward from front to rear. As the wearer leans toward a given side of the skate (e.g. the right side), the axles 16 extending from that side will move along the slots 66 upwards and towards the center of the skate 10, thereby pivoting about an axle pivot axis (which is generally perpendicular to the side walls 68 of the slots 66) and causing the rear wheel 18b and the front wheel 18a on that side (e.g. the right side) to pivot towards one another. In a similar manner, the wheels on the side of the skate opposite the lean (e.g. the left side) will be pivoted away from one another. This pivoting of the wheels will allow the skate 10 to turn in an arc in the direction of the wearer's lean while maintaining all four wheels in contact with the ground.

[0064] With reference to Figures 3 and 13, the axles 16 will contact the side walls 68 of the slots 66 formed in the sides of the skate chassis 12. If desired, the side walls 68 of the slots and/or the portions of the axles 16 which contact the slot side walls 68 could be coated with, covered by, or surrounded by a surface having a low coefficient of friction, and a high degree of wear resistance. For instance, the surfaces could be coated with a TEFLON coating, or other friction-reducing coating. Alternatively, a nylon sleeve 70 can be provided to surround a portion of the axles 16 which contact the slot side walls 68. Alternatively still, any other suitable friction-reducing and/or wear resistant coating or material can be used at the interface between the axles 16 and the slot side walls 68.

[0065] The radius of the arc, and thus the degree of the turn, will partly depend on factors such as the angle θ of the slots 66, the length 'ℓ' of the slots 66 and the parallel distance 'd' between the axles 16. Thus any or all of these or other values may be varied in order to achieve a desired turning radius or other control characteristic. In some embodiments, the slots 66 are oriented at an angle θ of between about 10° and about 60° relative to the horizontal, often between about 30° and about 45°, and in the illustrated embodiment, the slots 66 are oriented at an angle θ of at about 30° relative to the horizontal. The slots 66 can also have lengths ℓ of about ½" to about 2", often about ¾" to about 1 ½", and in one particular embodiment, the slots 66 are about 1 3/8" long. The parallel distance between the axles 16 can depend, at least in part, on the shoe size a specific skate is adapted to fit. Alternatively, the distance between the axles 16 can be maintained within a limited range, and the lengths of the toe and heel portions can be varied to achieve the desired range

of shoe sizes as discussed above. In some embodiments, for example, the distance between the axles 16 can be between about 4" and about 9" often the distance is between about 5" and about 7", and in one embodiment, the parallel distance between the axles 16 is about 6 ¾".

[0066] The axles 16 are typically resiliently biased toward a straight-ahead position in which the front 16a and rear 16b axles are parallel to one another. Any number of biasing mechanisms may be used to bias the axles toward a straight-ahead position. For example, one or both axles may be biased by one or more coil springs, leaf springs, elastic bands, or resilient blocks. In one embodiment, illustrated for example in Figure 12, resilient torque blocks 80 sandwiched between the top 34 and bottom 36 chassis halves are used to support the axles 16 and bias them toward a straight-ahead position.

[0067] With reference to Figures 12 and 15, 16a and 16b, torque blocks 80 can be provided to surround central portions of the front and rear axles 16a and 16b in order to support the axles and bias them toward a straight-ahead position. In some embodiments, the torque blocks 80 are solid sections of rubber, polyurethane, or other resilient material which may be molded around the solid axles 16. Alternatively, each torque block 80 can be made as a two-piece block 82a and 82b such as that shown in Figures 16a and 16b for example, which can be assembled around an axle 16. The block shown in Figure 16a also includes features adapted to retain the pieces 82a and 82b of the torque block 80 assembled about the axle 16.

[0068] With reference to Figure 16a, such features may include the barbed post 84 arrangement shown. The torque block halves 82 generally include prismatic bodies with mating faces 90, each face having a first recess 122 for receiving an axle 16, and a second recess 124 for receiving a cross pin 88. The block halves 82 can also include barbed posts 84 configured to "snap" onto the cross pin in order to retain a pin 88 and an axle 16 in a given torque block half 82. Alternatively, the barbed posts could be adapted to snap onto the axle, and/or the mating torque block half 82. The illustrated block halves 82 are substantially identical to one another, and are configured to be assembled to one another. Alternatively, other structure recognized as suitable for holding the two pieces 82a and 82b together can also be used. Alternatively still, a two-piece torque block 82 can be provided without such retaining structures, in which case the two pieces 82a and 82b can be held together by adhesives or merely by being compressed between boxes 86 in the top and bottom chassis

halves 34 and 36 (see Figures 3 and 4). As illustrated in the embodiment of Figure 16b, a torque block 80 can include concavities 125 on either side of the cross-pin recess 24. The dimensions of the concavities can be increased or decreased in order to vary the resilience of the torque block and its ability to return the axle to a central position.

[0069] The assemblable torque block 80 of Figures 16a and 16b can comprise a pair of substantially identical halves 82a and 82b which can be assembled to form a torque block 80 which encapsulates the axle 16 and a cross pin 88. The cross pin 88 will generally act to restrict lateral motion of the axle 16 (e.g. motion along the longitudinal axis of the axle) relative to the torque block 80 and the skate chassis 12. The torque block 80 can be adapted to receive the axle 16 and cross pin 88 such that the longitudinal axes of both the axle 16 and the cross pin 88 are parallel to a face 90 of each torque block half 82. Alternatively, the torque block halves 82 could be configured to receive a cross pin 88 such that a longitudinal axis of the cross pin 88 is perpendicular or otherwise non-parallel to the face 90 of the torque block half 82.

[0070] As shown in Figures 12 and 15-17, each axle 16 can include a cross pin or pivot pin 88 inserted through a transverse hole 92 at the linear center of the axle 16. The pin 88 substantially prevents the axle 16 from lateral (along the axis of the axle) movement. Additionally, the pin 88 can be positioned in the torque block 80 such that the pin 88 is substantially perpendicular to the slots 66 in the chassis 12 through which the axle 16 extends. This provides the unique advantage of allowing the pin 88 to provide support along the axis about which the axle 16 pivots during the turning motion described above. If desired, the pin 88 could be sized to extend through the torque block 80 and into portions of the skate chassis 12 in order to provide additional support along the axle pivot axis. In alternative embodiments, the axle 16 can be restrained from lateral movement relative to the chassis 12 by any other suitable mechanism such as one or more pins located at other appropriate positions along the length of the axle 16, or shaft collars positioned to abut a portion of the chassis 12.

[0071] The torque blocks 80 can be formed in a variety of shapes and sizes as desired. For example, the torque blocks 80 can be substantially rectangular prisms (as assembled), spheres, or any other prismatic or even substantially amorphous shape such that the blocks 80 resiliently bias the axles 16 toward a straight-ahead position. Additionally,

resilient torque blocks 80 can be positioned at any location along the axles 16 in order to bias the axles toward a straight-ahead position.

[0072] The torque blocks 80 can be made of a resilient material having a wide range of durometers. The particular durometer of the material from which the torque blocks 80 are made will typically vary depending on various factors such as the type of skating to be done, or the ability level of a skater. For example, a wearer desiring a relatively soft and easy turning ability will likely want a torque block 80 with a relatively low durometer, such as in the range of about 35 to about 45 (Shore A scale), and a wearer desiring a stiffer, less compliant steering will likely want torque blocks 80 with a somewhat higher durometer, such as in the range of about 45 to about 75 (Shore A scale). In general, torque block durometers can be provided in the range of about 30 to about 120 (Shore A scale), often in the range of about 35 to about 80 (Shore A scale), and preferably 50 to about 70 (Shore A scale).

[0073] In still another alternative embodiment, the torque blocks 80 may be molded or otherwise formed from a resilient material with substantially visco-elastic properties. The compressibility and resilience of such a material will exhibit both properties generally associated with viscous materials, and properties associated with elastic materials in response to an applied load. For example, a very quickly applied load (such as striking the material with a hammer) will result in very little compression, and a substantially high resilience. Similarly, a more slowly applied load (such as clamping the material in a pair of pliers) will result in substantially more compression, and substantially less resilience. Such a material is available from Sorbothane Inc. in Kent, Ohio, under the Trademark SORBOTHANE. A visco-elastic polyurethane for use as described herein can have a durometer in the range of about 20 to about 80 (Shore 00 scale), often in the range of about 30 to about 50 (Shore 00 scale), and in one embodiment about 40 (Shore 00 scale).

[0074] With continued reference to Figures 12 and 15, shock pads 94 can also be positioned above the torque blocks 80 to provide additional shock absorption for shock loads incurred during jumping or other maneuvers which involve shock loads. Typically, when a shock load is applied to the skate 10, the impact between the wheels 18 and the ground will be transmitted through the wheels 18, through the axles 16, through the torque blocks 80, through the shock pads 94, through the skate chassis 12 and ultimately to the wearer. Most of these components are relatively rigid, and thus do not offer significant shock absorption.

Some shock will be absorbed by the wheels 18, and some will be absorbed by the torque blocks 80, but if, for example, the torque blocks are optimized for maximum control and turning function, they might not provide sufficient shock absorption for a comfortable landing/ride. Thus, by providing an additional shock absorbing element between the ground and the wearer, the shock force experienced by the wearer can be greatly reduced.

[0075] Shock pads 94 useful for a skate 10 such as that shown and described herein are typically made of a substantially elastic or visco-elastic material and can be positioned directly above the torque blocks 80. The thickness of the shock pads 94 can be varied according to the degree of shock absorption desired. For example, the shock pads 94 can have thicknesses of between about 1/8" and about ½", often between about 3/16" and about 3/8", and in one embodiment the thickness of a shock pad is about ¼". As illustrated in Figure 12, the front 94a and rear 94b shock pads can be differently sized in order to dissipate varying amounts of shock. The skilled artisan will recognize that a substantially larger amount of the shock will be encountered by the wearer's heel, thus by providing a thicker rear shock pad 94b, the additional shock encountered by the rear of the skate relative to the front of the skate can be more easily dissipated. Shock pads 94 can be provided in a range of durometers depending on the desired degree of shock absorption. For example, Shock pads 94can be provided with durometers of between about 30 and about 60 (Shore A scale). Additionally, the shock pads 94 can have the same or substantially the same dimensions (as viewed in plan view from above) as the torque blocks 80. Alternatively, the shock pads 94 could have larger or smaller plan view dimensions relative to the torque blocks 80 as desired.

[0076] The axles 16 can be made from a variety of materials in a number of shapes and sizes. For example, although the axles 16 are illustrated as being substantially cylindrical solid rods, the axles 16 can comprise any cross-sectional shape such as square, rectangular, octagonal, etc., such that the pair of wheels 18 supported at opposite ends of a given axle 16 share a common rotational axis. In some embodiments, the axles 16 are made of a metal such as steel or aluminum. In one particular embodiment, the axles can be 7575 T6 Al rods. If needed, a pin 88 can be inserted through a transverse hole 92 in an axle. In one embodiment, a 1" long, 1/8" diameter roll pin is used, but pins of other sizes, shapes, and sizes can also be used as desired.

[0077] The axles 16 can be any appropriate length or diameter as desired. For example, the axles 16 can be between about 3/16" and about ½" in diameter, typically between about ¼" and about 7/16", and in one particular embodiment the axles 16 have a diameter of about 3/8". Axle diameters outside of these ranges can also be used depending on the selected material and other design parameters as will be clear to the skilled artisan. As seen in Figures 5-7, the front axle 16a, at a wider portion of the chassis 12, is longer than the rear axle 16b, located at a narrower portion of the chassis 12, such that the rear wheels 18b do not necessarily track directly behind the front wheels 18a. In alternative embodiments, the axles 16 can be equal lengths such that the rear wheels 18b do track behind the front wheels 18a.

[0078] The wheels 18 can be any appropriate diameter, width and/or material as desired. In the illustrated embodiments, the wheels 18 are of such a diameter that the tops of the wheels 18 extend above the top of the skate platform 14. Alternatively, the wheels 18 may be of a larger or smaller diameter as desired. The wheels 18 can be any width as desired, but are often between about ¾" and about 2" wide, in some embodiments between about ¾" and about 1 ½" wide, and in one particular embodiment, the wheels are about 1" wide.

[0079] Figures 14 and 17-25 illustrate portions of an over-molded wheel 96 which can be used with a skate 10 as shown and described herein. The wheel 96 generally comprises an outer or front face 150, and an inner or rear face 152. The over-molded wheel 96 generally includes a hub 202 which is over-molded with a resilient plastic material to form a "tire" 100.

[0080] In one embodiment the hub 202 generally comprises a bearing ring 218, a hub ring 220 and a capture ring 222. The bearing ring 218 is attached to the hub ring 220 by a plurality of spokes 230. The spaces 232 between the spokes 230 create increased space for air flow while reducing the amount of material of the wheel hub, 202 and thereby reducing the overall weight of the wheel 96. In the illustrated embodiment, the front face 150 of the hub 202 comprises a solid covering 234 with a plurality of openings 236 extending between the front side of the wheel and the spaces 232 between the spokes on the rear side of the wheel. If desired, the covering 234 could be omitted, or could comprise openings of different shapes.

[0081] The capture ring 222 is attached to the hub ring 220 by an annular rib 224 which has a smaller width dimension than a width dimension of the capture ring 22 (see Figure 21). Thus, the hub 202 of this embodiment comprises an annular space 226 between the hub ring 220 and the capture ring 222 on both the front and rear sides of the annular rib 224.

[0082] In the illustrated embodiment, the shape of the capture ring 222 is particularly advantageous in allowing a urethane tire to be injection molded around the perimeter of the hub 202. When a thermoplastic material such as a urethane is injection molded over the capture ring 222, portions of the injection molded tire material will extend into the annular space 226 between the capture ring 222 and the hub ring 220.

[0083] In some embodiments, the tire 100 can be made of a material such as a polyester urethane, a thermoplastic urethane, or other resilient plastic material. In one embodiment, the central hub 202 can include a plurality of radially-extending ribs over which the plastic tire 100 can be molded or assembled.

[0084] In the illustrated embodiment, the hub 202 can include a central bearing-receiving aperture 106 configured to receive a pair of rotational bearings 118 (see Figure 14). The hub 202 can also include a recessed cavity 210 for receiving a nut for retaining the wheel 96 on the axle 16. In some embodiments, the bearing-receiving aperture 106 can include a shoulder 180 against which the bearings 118 can abut. The location of the shoulder 180 within the bearing-receiving aperture can be selected to allow a nut to be recessed from the front face 150 of the wheel (e.g. see Figure 14). If desired a second shoulder 182 can be provided to create an enlarged diameter space for receiving a nut.

[0085] The hub 202 can be made from any suitable material, such as metals, plastics, composites, etc. For example, the wheel hub 202 is made of a polyamide nylon #66 or acrylonitrile butadiene styrene (ABS).

[0086] The plastic tire 100 is preferably injection molded directly onto the hub 202 to advantageously provide a relatively inexpensively manufactured wheel which is lightweight and also substantially strong. Alternatively, the tire 100 can be molded separately and can be pressed onto the wheel hub 202. Alternatively still, the tire 100 can be compression molded, cast, or made by any other suitable process. In the case of a separately molded tire 100, the tire 100 is preferably molded to have an inner diameter 130 which is

slightly smaller than an outer diameter 132 of the hub 202. For example, tires 100 can be provided with an inner diameter 130 which is between about 90% and about 98% of the hub outer diameter 132 depending on the material properties of the plastic used for the tire 100. A separately molded and removable tire 100 can advantageously be replaced when it is worn down.

[0087] According to one embodiment, the tire 100 can be an injection molded urethane which is captured and retained on the hub 202 by the capture ring 222. In another embodiment, the hub 202 can be injection molded from a colored plastic material, and in some cases the hub can include glitter or other material to create a visual effect. In this embodiment, the tire 100 can be a clear urethane material that is injection molded over the hub 202 so as to create the visual illusion that the clear urethane material has the same color, shine, glitter or other surface finish as the hub 202.

[0088] One embodiment of an over-molded wheel 96 will advantageously provide good wear resistance by providing a wide contact area. Additional advantages of the injection molded wheel include: inexpensive production, lightweight, and lower material costs. Further advantages will also be appreciated by the skilled artisan. Any or all of the skate's wheels 18 can be over molded wheels 96 or any other suitable type of wheel.

[0089] With reference to Figures 3, 4, 15 and 16, embodiments of methods of assembling a skate having desired features and advantages will now be described. Many users may find it easiest to assemble the skate "upside down" by holding the top chassis half 34 upside down and placing the various components onto and into the top chassis half 34 as needed. Thus, the front and rear shock pads 94 can first be placed in the respective boxes 86 of the upper chassis half 34. If the skate is provided with a two-piece torque block 80 as described above, the first 82a and second 82b torque block halves will be assembled about the front and rear axles 16a and 16b. The front and rear torque block-axle assemblies can then be placed in the respective boxes 86 of the upper chassis half 34. The skilled artisan will note that the front and rear torque block-axle assemblies are preferably placed in the chassis 12 such that the cross pins 88 are perpendicular to the slots 66, thereby allowing the cross pins 88 to lie along the pivot axes of the axles 16. The attachment tabs 46 of the wings 20 can then be placed around the posts 38 of the upper chassis half 34, allowing the tabs 46 to extend through the cutouts 48 (see Figure 3).

[0090] The bottom chassis half 36 can then be placed onto the top chassis half 34 by aligning the holes with their respective posts 38, and also ensuring that the boxes 86 of the bottom chassis half 36 align with the torque blocks 80 positioned in the upper chassis half 34. Once the chassis 12 is completely assembled, the grind pad 24 can be aligned with its corresponding recess 60 in the bottom chassis half 36. The fasteners 55 can then be inserted through the holes 64 in the grind pad 24 and the bottom chassis half 36, and tightened until the grind pad 24 and bottom chassis half 36 are tightly secured to the top chassis half 34 with the wings 20, shock pads 94, torque blocks 80 and axles 16 sandwiched between the top and bottom chassis halves 34 and 36.

[0091] The brake pads 22 can then be installed by aligning the brake pads 22 with their respective openings 56 in the bottom chassis half 36, and positioning the brake pads 22 on their respective cruciform columns 39. Once the brake pads 22 are in position, the fasteners 54 can be inserted through the central holes of the brake pads 22 and tightened to secure the brake pads 22 to the skate 10.

[0092] The brake pads 22 can advantageously be replaced without disassembling the skate chassis 12 simply by removing the single screw 54 holding each pad 22, replacing the pad 22, and re-inserting the screw 54. Similarly, the grind pad 24 can be removed and replaced without necessarily disassembling the skate chassis 12. The grind pad 24 can be replaced by removing the main screws 55, removing and replacing the pad 24, and replacing the screws 55. The brake pads 22 can hold the chassis 12 together while the grind pad 24 is replaced.

[0093] Although certain embodiments and examples have been described herein, it will be understood by those skilled in the art that many aspects of the methods and devices shown and described in the present disclosure may be differently combined and/or modified to form still further embodiments. Additionally, it will be recognized that the methods described herein may be practiced using any device suitable for performing the recited steps. Such alternative embodiments and/or uses of the methods and devices described above and obvious modifications and equivalents thereof are intended to be within the scope of the present disclosure. Thus, it is intended that the scope of the present invention should not be limited by the particular embodiments described above, but should be determined only by a fair reading of the claims that follow.